

6N137 OPTOCOUPLER/OPTOISOLATOR

SOOS003 D291B, JULY 1986

- Gallium Arsenide Phosphide LED Optically Coupled to Integrated Circuit Detector
- Compatible with TTL and LSTTL Inputs
- Low Input Current Required to Turn Output On . . . 5 mA Max
- High-Voltage Electrical Insulation . . . 3000 V DC Min
- High-Speed Switching . . . 75 ns Max
- Plastic Dual-In-Line Package
- UL Recognized . . . File Number 65085

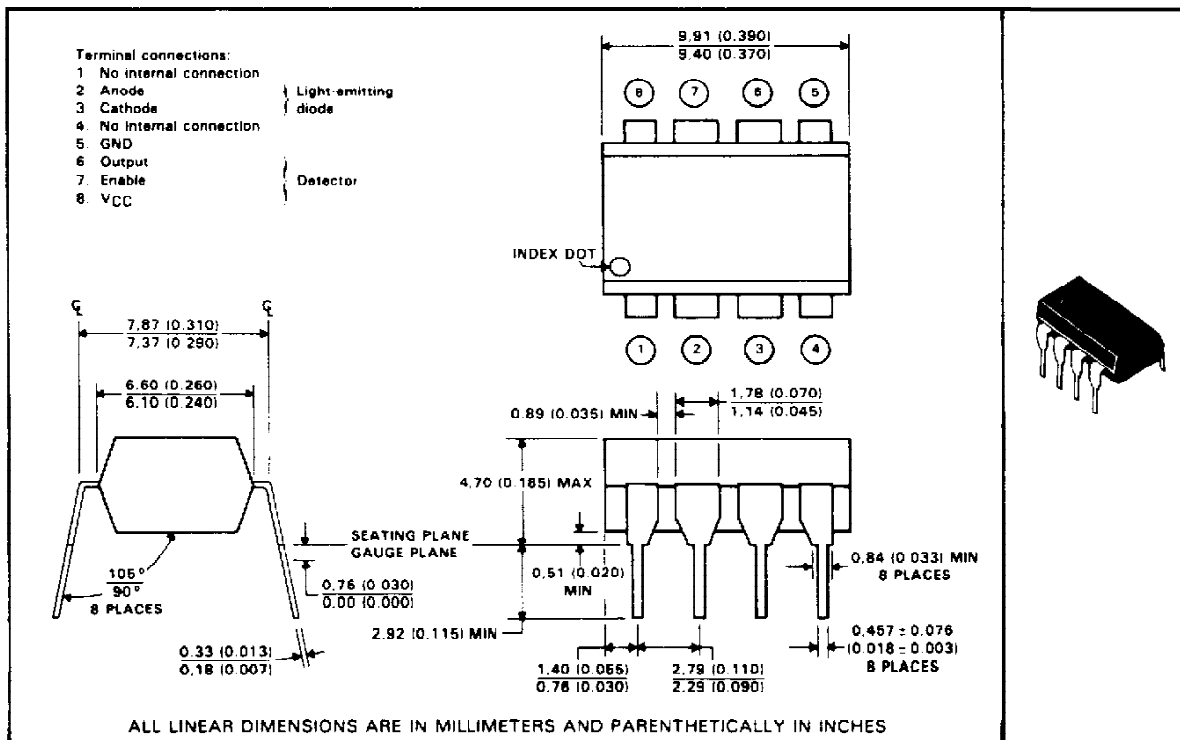
description

The 6N137 optocoupler is designed for use in high-speed digital interfacing applications that require high-voltage isolation between the input and output. Applications include line receivers, microprocessors or computer interface, digital programming of floating power supplies, motors, and other control systems.

The 6N137 high-speed optocoupler consists of a GaAsP light-emitting diode and an integrated light detector composed of a photodiode, a high-gain amplifier, and a Schottky-clamped open-collector output transistor. An input diode forward current of 5 milliamperes will switch the output transistor low, providing an on-state drive current of 13 milliamperes (eight 1.6-milliampere TTL loads). A TTL-compatible enable input is provided for applications that require output-transistor gating.

The 6N137 is characterized for operation over the temperature range of 0°C to 70°C.

*mechanical data



*JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.

PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 · DALLAS, TEXAS 75265

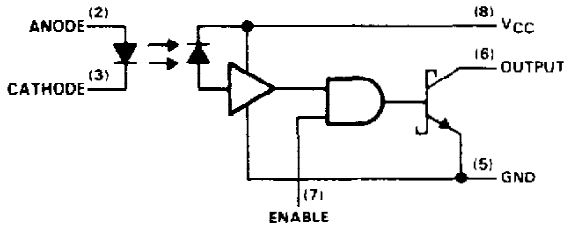
Copyright © 1986, Texas Instruments Incorporated

6N137
OPTOCOUPLER/OPTOISOLATOR

FUNCTION TABLE

INPUT	ENABLE	OUTPUT
I _{F(on)}	H	L
I _{F(off)}	X	H
X	L	H

logic diagram (positive logic)



***absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

Supply voltage, V _{CC}	7 V
Reverse input voltage	5 V
Enable input voltage (not to exceed V _{CC} by more than 500 mV)	5.5 V
Output voltage	7 V
Peak forward input current (≤ 1 ms duration) (TI-guaranteed value)	40 mA
(JEDEC-registered value)	20 mA
Average forward input current (TI-guaranteed value)	20 mA
(JEDEC-registered value)	10 mA
Output current	50 mA
Output power dissipation	85 mW
Storage temperature range	-55 °C to 125 °C
Operating free-air temperature range	0 °C to 70 °C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260 °C

*JEDEC registered data

recommended operating conditions

	MIN	NOM	MAX	UNIT
V _{CC} Output supply voltage (see Note 1)	4.5	5	5.5	V
V _{IH(EN)} High-level enable input voltage (see Note 2)	2		V _{CC}	V
V _{IL(EN)} Low-level enable input voltage	0		0.8	V
I _{F(on)} Input forward current to turn output on	6.3		15	mA
I _{F(off)} Input forward current to turn output off	0		250	μA
I _{OL} Low-level (on-state) output current			13	mA
T _A Operating free-air temperature	0		70	°C

- NOTES: 1. All voltage values are with respect to GND (pin 5).
 2. No external pullup is required at the enable input; an open circuit will establish the high level.

6N137
OPTOCOUPLER/OPTOISOLATOR

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
*V _F Input forward voltage	I _F = 10 mA, T _A = 25°C		1.6	1.75	V
αV _F Temperature coefficient of forward voltage	I _F = 10 mA		-1.8		mV/°C
*V _{BR} Input reverse breakdown voltage	I _R = 10 μA, T _A = 25°C	5			V
*V _{OL} Low-level output voltage	V _{CC} = 5.5 V, V _{I(EN)} = 2 V, I _F = 5 mA, I _{OL} = 13 mA		0.23	0.6	V
*I _{OH} High-level output current	V _{CC} = 5.5 V, V _O = 5.5 V, V _{I(EN)} = 2 V, I _F = 250 μA			250	μA
I _{H(EN)} High-level enable input current	V _{CC} = 5.5 V, V _{I(EN)} = 2 V		-0.2		mA
*I _{L(EN)} Low-level enable input current	V _{CC} = 5.5 V, V _{I(EN)} = 0.5 V		-0.5	-2	mA
*I _{CCH} Supply current, high-level output	V _{CC} = 5.5 V, V _{I(EN)} = 0.5 V, I _F = 0		10	15	mA
*I _{CCL} Supply current, low-level output	V _{CC} = 5.5 V, V _{I(EN)} = 0.5 V, I _F = 10 mA		13	18	mA
*I _{IO} Input-output insulation leakage current	V _{IO} = 3000 V, t = 5 s, T _A = 25°C, RH = 45%, See Note 1			1	μA
r _{IO} Input-output resistance	V _{IO} = 500 V, T _A = 25°C, See Note 1		10 ¹²		Ω
C _i Input capacitance	V _F = 0, f = 1 MHz		60		pF
C _{IO} Input-output capacitance	f = 1 MHz, T _A = 25°C, See Note 1		0.6		pF

*JEDEC registered data

† All typical values are at V_{CC} = 5 V, T_A = 25°C

NOTE 1: These parameters are measured between pins 2 and 3 shorted together and pins 5, 6, 7, and 8 shorted together.

switching characteristics at V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
*t _{PLH} Propagation delay time, low-to-high-level output, from LED input	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 1		42	75	ns
*t _{PHL} Propagation delay time, high-to-low level output, from LED input	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 1		42	75	ns
t _{PLH(EN)} Propagation delay time, low-to-high level output, from enable	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 2		40		ns
t _{PHL(EN)} Propagation delay time, high-to-low-level output, from enable	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF, See Figure 2		25		ns
t _r Rise time	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF		20		ns
t _f Fall time	I _F = 7.5 mA, R _L = 350 Ω, C _L = 15 pF		30		ns
$\frac{dV_{CM}}{dt}$ (H) Common mode input transient immunity, high-level output	ΔV _{CM} = 10 V, I _F = 0, R _L = 350 Ω, See Note 2 and Figure 3		50		V/μs
$\frac{dV_{CM}}{dt}$ (L) Common-mode input transient immunity, low-level output	ΔV _{CM} = -10 V, I _F = 5 mA, R _L = 350 Ω, See Note 2 and Figure 3		-150		V/μs

*JEDEC registered data

NOTE 2: Common-mode input transient immunity, high-level output, is the maximum rate of rise of the common-mode input voltage that does not cause the output voltage to drop below 2 V. Common-mode input transient, low-level output, is the maximum rate of fall of the common-mode input voltage that does not cause the output voltage to rise above 0.8 V.

**6N137
OPTOCOUPLER/OPTOISOLATOR**

PARAMETER MEASUREMENT INFORMATION

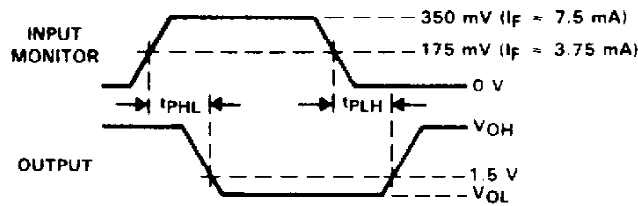
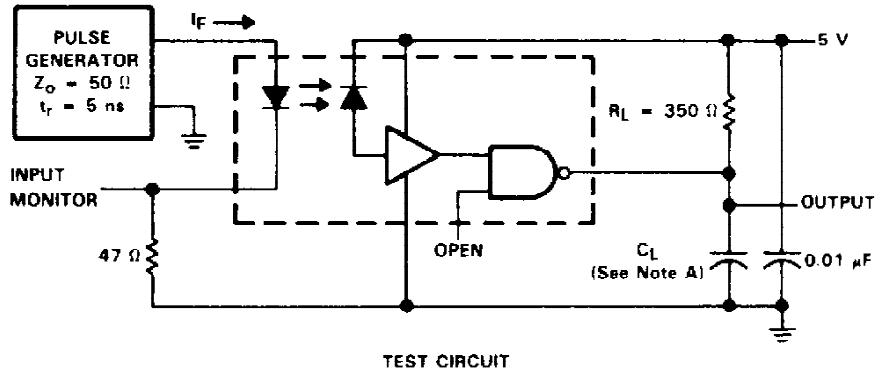


FIGURE 1. t_{PLH} AND t_{PHL} FROM LED INPUT TEST CIRCUIT AND WAVEFORMS

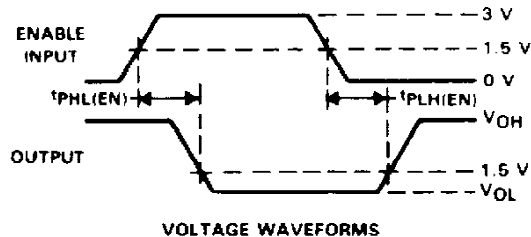
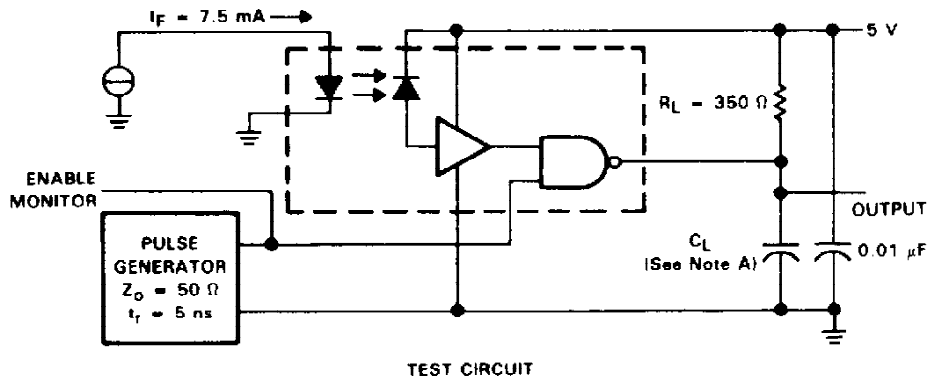


FIGURE 2. t_{PLH(EN)} AND t_{PHL(EN)} FROM ENABLE TEST CIRCUIT AND WAVEFORMS

NOTE A: C_L is approximately 15 pF, which includes probe and stray wiring capacitances.

PARAMETER MEASUREMENT INFORMATION

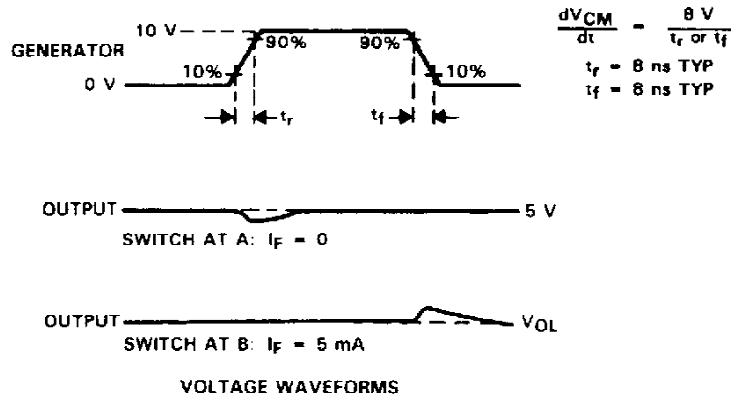
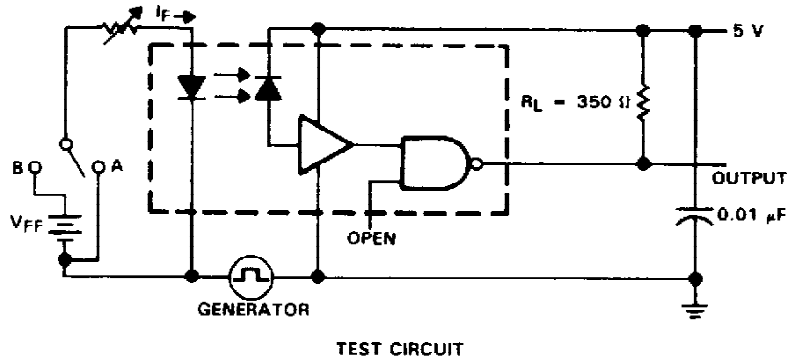


FIGURE 3. TRANSIENT IMMUNITY TEST CIRCUIT AND WAVEFORMS

TYPICAL APPLICATION INFORMATION

A ceramic capacitor (0.01 μF to 0.1 μF) should be connected between pins 8 and 5 to stabilize the high-gain amplifier. The total lead length between the capacitor and the optocoupler should not exceed 20 mm (0.8 inches). Failure to provide a bypass capacitor may result in impaired switching characteristics.

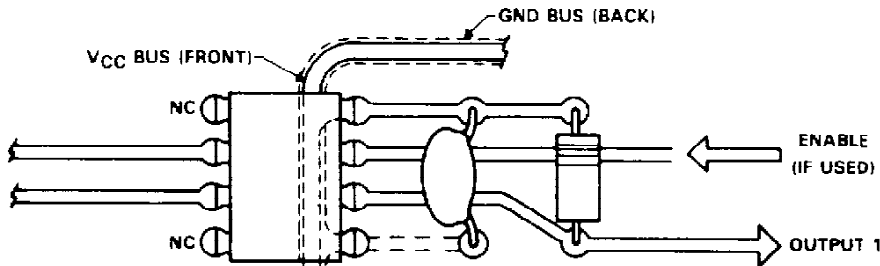


FIGURE 4. RECOMMENDED PRINTED CIRCUIT BOARD LAYOUT

6N137
OPTOCOUPLER/OPTOISOLATOR

TYPICAL CHARACTERISTICS

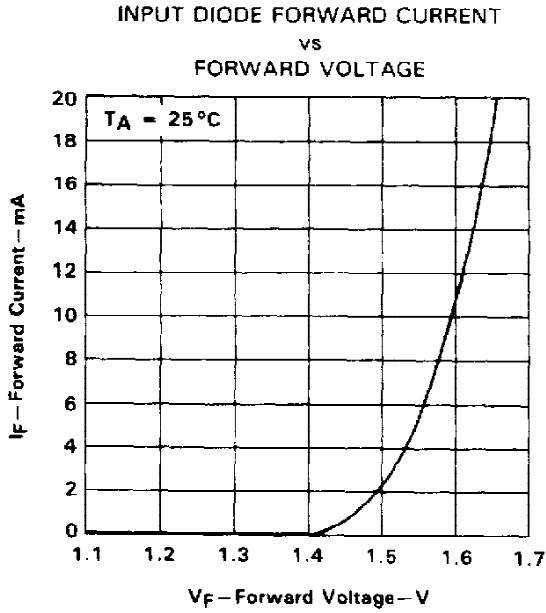


FIGURE 5

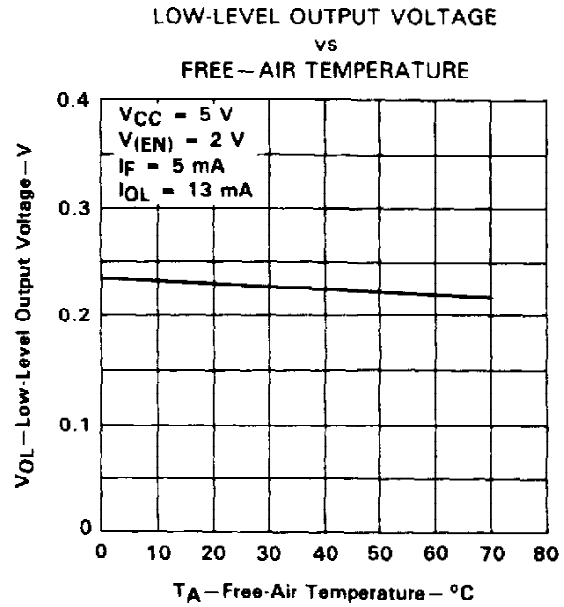


FIGURE 6

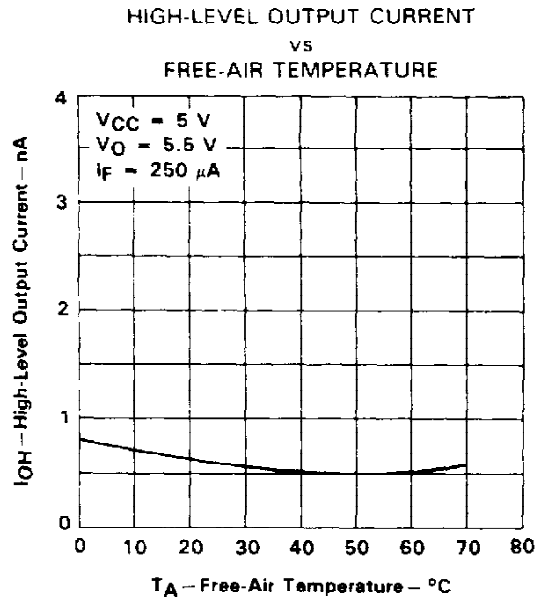


FIGURE 7

TYPICAL CHARACTERISTICS

PROPAGATION DELAY TIME FROM LED INPUT
vs
PULSE FORWARD CURRENT

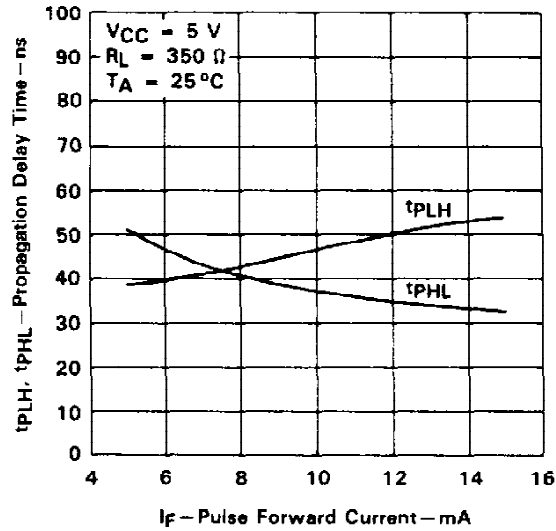


FIGURE 8

PROPAGATION DELAY TIME FROM LED INPUT
vs
LOAD RESISTANCE

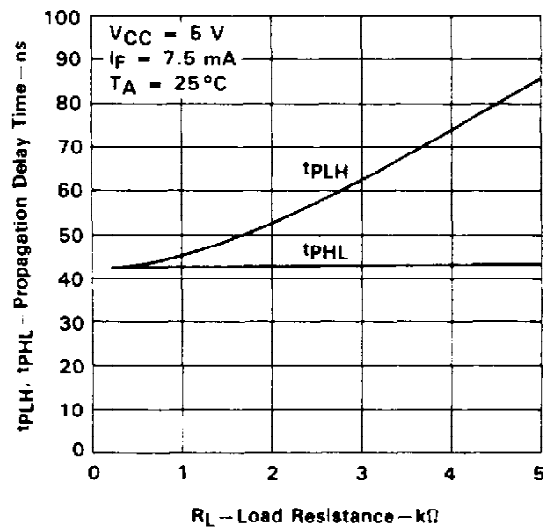


FIGURE 9

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
6N137	OBSOLETE	PDIP	N	8		TBD	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265